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			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER 622786		
6. AUTHORS Robert Brackett, Ph.D., Jason Wan, Ph.D, Alvin Lee, Ph.D., Armand Paradis			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
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13. SUPPLEMENTARY NOTES The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other documentation.					
14. ABSTRACT The National Center for Food Safety and Technology (NCFST) is a consortium among Illinois Institute of Technology, The U.S. Food and Drug Administration (FDA) and the food industry. NCFST's research is implemented through science platforms that reflect the organization's expertise: food processing and packaging, food microbiology, chemical contaminants and allergens, nutrition, and proficiency testing and method validation programs. The NCFST seeks to build on its strong foundation and history of the collaboration with industry, FDA and academia to increase its research portfolio and expand its partnership with its stakeholders. By conducting					
15. SUBJECT TERMS National Center for Food Safety and Technology					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	15. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON Robert Brackett
a. REPORT UU	b. ABSTRACT UU	c. THIS PAGE UU			19b. TELEPHONE NUMBER 708-563-1577

## **Report Title**

National Center for Food Safety and Technology  
Final Report

### **ABSTRACT**

The National Center for Food Safety and Technology (NCFST) is a consortium among Illinois Institute of Technology, The U.S. Food and Drug Administration (FDA) and the food industry. NCFST's research is implemented through science platforms that reflect the organization's expertise: food processing and packaging, food microbiology, chemical contaminants and allergens, nutrition, and proficiency testing and method validation programs. The NCFST seeks to build on its strong foundation and history of the collaboration with industry, FDA and academia to increase its research portfolio and expand its partnership with its stakeholders. By conducting important research on critical food processing issues to address food safety and nutrition, NCFST can help improve the health and well-being of the public.

**Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:**

**(a) Papers published in peer-reviewed journals (N/A for none)**

<u>Received</u>	<u>Paper</u>
12/05/2013 14.00	Ravi Kiran Tadapaneni, Katarzyna Banaszewski, Eduardo Patazca, Indika Edirisinghe, Jack Cappozzo, Lauren Jackson, Britt Burton-Freeman. Effect of High-Pressure Processing and Milk on the Anthocyanin Composition and Antioxidant Capacity of Strawberry-Based Beverages, Journal of Agricultural and Food Chemistry, (06 2012): 0. doi: 10.1021/jf2035059
12/05/2013 12.00	Haiping Li, Anuhya Bhaskara, Christina Megalis, Mary Lou Tortorello. Transcriptomic Analysis of Salmonella Desiccation Resistance , Foodborne Pathogens and Disease, (12 2012): 0. doi: 10.1089/fpd.2012.1254
12/05/2013 13.00	Y. Sun, D. T. Laird, Y. C. Shieh. Temperature-Dependent Survival of Hepatitis A Virus during Storage of Contaminated Onions, Applied and Environmental Microbiology, (04 2012): 0. doi: 10.1128/AEM.00402-12
12/05/2013 15.00	William H. Tolleson, Lauren S. Jackson, Odber A. Triplett, Bharat Aluri, Jack Cappozzo, Katie Banaszewski, Claire W. Chang, Kiet T. Nguyen. Chemical Inactivation of Protein Toxins on Food Contact Surfaces, Journal of Agricultural and Food Chemistry, (07 2012): 0. doi: 10.1021/jf301601v
12/05/2013 16.00	Artemio Z. Tulio, Claire Chang, Indika Edirisinghe, Kevin D. White, Joseph E. Jablonski, Katarzyna Banaszewski, Archana Kangath, Ravi K. Tadapaneni, Britt Burton-Freeman, Lauren S. Jackson. Berry Fruits Modulated Endothelial Cell Migration and Angiogenesis via Phosphoinositide-3 Kinase/Protein Kinase B Pathway in Vitro in Endothelial Cells, Journal of Agricultural and Food Chemistry, (06 2012): 0. doi: 10.1021/jf3001636
12/05/2013 17.00	Nasson R. Mwakatage, Renee Goodrich-Schneider, Kathiravan Krishnamurthy, Taha M. Rababah, Wade W. Yang. Mitigation of Major Peanut Allergens by Pulsed Ultraviolet Light, Food and Bioprocess Technology, (06 2011): 0. doi: 10.1007/s11947-011-0615-6
12/05/2013 2.00	Roman Buckow, Julius Semrau, Qian Sui, Jason Wan, Kai Knoerzer. Numerical evaluation of lactoperoxidase inactivation during continuous pulsed electric field processing, Biotechnology Progress, (09 2012): 0. doi: 10.1002/btpr.1582
12/05/2013 5.00	Xiangyu Deng, Zengxin Li, Wei Zhang. Transcriptome sequencing of Salmonella enterica serovar Enteritidis under desiccation and starvation stress in peanut oil, Food Microbiology, (05 2012): 0. doi: 10.1016/j.fm.2011.11.001
12/05/2013 3.00	Yang Chen, Fadwa Al-Taher, Rima Juskelis, Jon W. Wong, Kai Zhang, Douglas G. Hayward, Jerry Zweigenbaum, Joan Stevens, Jack Cappozzo. Multiresidue Pesticide Analysis of Dried Botanical Dietary Supplements Using an Automated Dispersive SPE Cleanup for QuEChERS and High-Performance Liquid Chromatography–Tandem Mass Spectrometry, Journal of Agricultural and Food Chemistry, (10 2012): 0. doi: 10.1021/jf301723g
12/05/2013 4.00	Julie Talbot, Britt Burton-Freeman, Eunyoung Park, Sandhya Krishnankutty, Indika Edirisinghe. Protective activity of processed tomato products on postprandial oxidation and inflammation: A clinical trial in healthy weight men and women, Molecular Nutrition & Food Research, (04 2012): 0. doi: 10.1002/mnfr.201100649

- 12/05/2013 6.00 David Douglas, Katie Banaszewski, Rima Juskelis, Fadwa Al-Taher, Yang Chen, Jack Cappozzo, Lindsay McRobbie, Robert S. Salter. Validation of a Rapid Lateral Flow Test for the Simultaneous Determination of  $\beta$ -Lactam Drugs and Flunixin in Raw Milk, Journal of Food Protection, (07 2012): 0. doi: 10.4315/0362-028X.JFP-11-570
- 12/05/2013 7.00 Emily E. Jackson, Edibe S. Erten, Neeraj Maddi, Thomas E. Graham, John W. Larkin, Robert J. Blodgett, Joseph E. Schlessner, Ravinder M. Reddy. Detection and Enumeration of Four Foodborne Pathogens in Raw Commingled Silo Milk in the United States, Journal of Food Protection, (08 2012): 0. doi: 10.4315/0362-028X.JFP-11-548
- 12/05/2013 8.00 L.S. Jackson, K.A. Voss, D. Ryu. Effects of different extrusion conditions on the chemical and toxicological fate of fumonisin B<sub>1</sub> in maize: a short review, World Mycotoxin Journal, (08 2012): 0. doi: 10.3920/WMJ2012.1431
- 12/05/2013 9.00 Susanne E. Keller, Elizabeth M. Grasso, Lindsay A. Halik, Gregory J. Fleischman, Stuart J. Chirtel, Stephen F. Grove. Effect of Growth on the Thermal Resistance and Survival of *Salmonella* Tennessee and Oranienburg in Peanut Butter, Measured by a New Thin-Layer Thermal Death Time Device, Journal of Food Protection, (06 2012): 0. doi: 10.4315/0362-028X.JFP-11-477
- 12/05/2013 10.00 Elmer C. Bigley, Thomas Whitaker, Kristina Williams, Sefat Khuda, Andrew Slate, Marion Pereira, Fadwa Al-Taher, Lauren Jackson, Carmen Diaz-Amigo. Effect of Processing on Recovery and Variability Associated with Immunochemical Analytical Methods for Multiple Allergens in a Single Matrix: Dark Chocolate, Journal of Agricultural and Food Chemistry, (05 2012): 0. doi: 10.1021/jf3001845
- 12/05/2013 11.00 Sefat Khuda, Andrew Slate, Marion Pereira, Fadwa Al-Taher, Lauren Jackson, Carmen Diaz-Amigo, Elmer C. Bigley, Thomas Whitaker, Kristina M. Williams. Effect of Processing on Recovery and Variability Associated with Immunochemical Analytical Methods for Multiple Allergens in a Single Matrix: Sugar Cookies, Journal of Agricultural and Food Chemistry, (05 2012): 0. doi: 10.1021/jf3001839

**TOTAL: 16**

**Number of Papers published in peer-reviewed journals:**

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**(b) Papers published in non-peer-reviewed journals (N/A for none)**

Received      Paper

**TOTAL:**

Number of Papers published in non peer-reviewed journals:

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**(c) Presentations**

Institute of Food Technology (IFT) Conference – July 2013

1. Xueyan Wang, Hongliu Ding and Y. Carol Shieh. 2013. Inactivation of Murine Norovirus during Freeze-dry Dehydration of Contaminated Strawberry.
2. Tianyi Jiang, Susanne E. Keller, Emily Larkin. 2013. Growth of Salmonella sp. on Different Varieties of Commercially Available Chili Peppers (*Capsicum annum*).
3. Fei Yang, Haiping Li, Yige Bima, Mary Lou Tortorello. 2013. Water Binding Capacity of Low Moisture Food Matrix and Salmonella Survival.
4. Jingbo Wang, Yan Sun, Diana S. Stewart, Y. Carol Shieh. 2013. Persistent but Variable Transfers of Norovirus from Blades to Tomatoes during Mechanical Slicing.
5. Shengqian Sun, Nathan M. Anderson, Susanne Keller. 2013. Effect of Abusive Storage Conditions on the Subsequent Inactivation of Salmonella on the Surface of Black Peppercorns by Atmosphere Pressure Plasma.
6. Xi Zhang, Binu Bedford, Tong-Jen Fu, Sanjana Nekkanti, Mark Ross, Kristina Williams, Jon DeVries, Brian Pulvermacher, Sefat Khuda, Stuart Chirtel, Lauren Jackson. 2013. Effectiveness of Cleaning Regimens for Removing Peanut, Milk and Eggs Residue from a Pilot-scale Cereal Bar Processing Line.
7. Xueqing Chen, Nathan M. Anderson, Kathiravan Krishnamurthy. 2013. Pulsed Light Inactivation of Salmonella spp. on Black Peppercorns.

International Association for Food Protection (IAFP) Conference – July 2013

8. Tong-Jen Fu, Nicole Maks, Arlette Shazer, Di Xiao. 2013. Evaluation of Commercial Test Kits for Detection of Salmonella in Alfalfa Sprout Spent Irrigation Water
9. Mingxia Zang, Yu Tian, Xinhe Wang, David Laird, Tong-Jen Fu. 2013. Investigation on the Spread of Salmonella and Factors Affecting the Efficacy of Sanitizer during Postharvest Washing of Lettuce.
10. Jing Xie, Tong-Jen Fu. 2013. Minimizing Salmonella Contamination in Sprouts by Controlling the Irrigation Conditions during Germination
11. Ruoyang Xu, Y. Carol Shieh, Diana S. Stewart. 2013. Comparison of RNA Extraction Kits for the Detection of MS2 Coliphage on Green Onion via RT-PCR
12. Nathan M. Anderson, Dana Gradl, Shannon Pickens, Niharika Mishra, Haiping Li, Susanne Keller. 2013. Method of Determine Differences in Thermal Tolerance of Salmonella Serotypes at Low Water Activity
13. Chao Zhou, Jianfeng Wang, Mingxia Zang, David Laird, Tong-Jen Fu. 2013. The Impact of Organic Load on the Minimal Level of Chloride Needed to Prevent *E. coli* O157:H7 Cross-contamination during Washing of Fresh-cut Lettuce
14. Kaiping Deng, Xue Wang, Hongliu Ding, Mary Lou Tortorello. 2013. Behaviour of Shiga Toxin-producing *E. coli* (STEC) Strains during Lettuce Washing
15. Michael A. Urbanczyk Jr., Greg Gharst, Robert Newkirk, Robin Kalinowski, Tara Doran, Ruiqing Pamboukian, Wen S. Lin, Ravinder M. Reddy. 2013. Proficiency Testing of Laboratories Analyzing *Shigella flexneri* and *Shigella dysenteriae* from Spiked Sausage
16. Jiaojie Zheng, Songchuan Ma, Dina S. Steward, Joseph E. Schlessner, Y. Carol Shieh, Arlette Shazer, Mary Lou Tortorello. 2013. An Integrated Cell Culture-PCR (ICC-PCR) Assay for Comparing Thermal Inactivation of *Coxiella burnetii* in Skim and Whole Milk
17. Elizabeth M. Grasso, Susanne Keller, Nathan M. Anderson, Stephen F Grove. 2013. Push-through Sanitation of Peanut Butter Processing Equipment
18. Travis R. Morrissey, Viviana Loeza, Guy E. Skinner, Lindsay A. Halik, Eduardo Patazca, Kristin M. Marshall, N. Rukma Reddy, John W. Larkin. 2013. Inactivation of Non-proteolytic Strains of *Clostridium botulinum* Spores by High Pressure and Thermal Processing
19. Louis Nowaczyk, Kristin M. Marshall, Greg Fleischman, Guy E. Skinner, N. Rukma Reddy, John W. Larkin. 2013. The Effect of Sporulation Temperature on the Heat Resistance of *Clostridium botulinum* Type A Spores

FDA Science Day – Foods Program Science and Research Conference - August 2013

20. Ravinder M. Reddy, Greg Gharst, Steffen Uhlig, Donald H. Burr, Robin Kalinowski, Tara Doran, Thomas E. Graham, Randal Layton, Timothy McGrath, Palmer A. Orlandi Jr., Renate Reimschuessel, Richard E. McDonald. 2013. National Food and Veterinary Proficiency Testing Programs

AOAC International – August 2013

21. Yang Chen, Ramesh R. Yettella, Sarah Nemser, Andriy Tkachenko, Steve Ensley, Ravinder M. Reddy, Renate Reimschuessel. 2013. Proficiency Test on the Determination of Copper, Iron, Manganese and Zinc in Beef and Goat Liver

American Chemical Society (ACS) – September, 2013

22. Meng Xu, Tong-Jen Fu. 2013. Approaches to Quantify and Compare the Thermal Stability of Food Allergens
23. Binu Bedford, Christine H. Parker, Mark M. Ross, Stuart Chirtel, Joseph Jablonski, Lauren S. Jackson. 2013. Transfer of Peanut Proteins into Soybean Oil Used to Roast Peanuts
24. Clair Wei-Ju Chang, Joseph Jablonski, Xitong Li, Lucy Botros, Jeff Moore. 2013. Chemometric Analysis Method Evaluation for Near

Berry Health Symposium – June 2013

25. Claire Wei-Ju Chang, Archana Kangath, Indika Edirisinghe, Britt Burton-Freeman, Lauren S. Jackson. 2013. Polyphenol-rich fruits attenuate angiogenesis in vitro in human umbilical vein endothelial cells (HUVEC) exposed to glucose and free fatty acid

Experimental Biology Meeting – November 2013

26. Yancui Huang, Brittany Wuchner, Sarah Thomas, Eunyoung Park, Indika Edirisinghe, Britt Burton- Freeman. 2013. Assessing Issue Awareness and Messaging on Purchasing Behavior of Fresh Fruits and Vegetables in Low-income Population

**Number of Presentations:** 26.00

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**Non Peer-Reviewed Conference Proceeding publications (other than abstracts):**

<u>Received</u>	<u>Paper</u>
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**TOTAL:**

**Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):**

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**Peer-Reviewed Conference Proceeding publications (other than abstracts):**

<u>Received</u>	<u>Paper</u>
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**TOTAL:**

**Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):**

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**(d) Manuscripts**

<u>Received</u>	<u>Paper</u>
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**TOTAL:**

Number of Manuscripts:

Books	
<u>Received</u>	<u>Paper</u>

TOTAL:

Patents Submitted

Patents Awarded

Awards



### Graduate Students

<u>NAME</u>	<u>PERCENT SUPPORTED</u>	<u>Discipline</u>
Agarwal, Sagar	0.19	
Bima, Yige	0.19	
Chen, Xueqing	0.19	
Chen, Zhengzai	0.19	
Fu, Xiaowen	0.19	
Han, Yibin	0.19	
Jin, Zhen	0.19	
Li, Wenjing	0.19	
Lu, Jieling	0.19	
Ma, Songchuan	0.19	
Mehta, Devanshu	0.19	
Na, Qishuo	0.19	
Nekkanti, Sanjana	0.19	
Sun, Shenqian	0.19	
Jiang, Tianyi	0.19	
Vijayakumar, Lakshmi Prabha	0.19	
Wang, Jingbo	0.19	
Wang, Xue	0.19	
Wang, Xueyan	0.19	
Wei, Hequin	0.19	
Wu, Zhuchun	0.19	
Xiao, Di	0.19	
Xie, Jing	0.19	
Xu, Jianwen	0.19	
Xu, Ruoyang	0.19	
Xu, Meng	0.19	
Yang, Fei	0.19	
Yang, Shuopeng	0.19	
Yang, Si	0.19	
Yen, Lihan	0.19	
Yu, Tian	0.19	
Zang, Mingxia	0.19	
Zhang, Hanshuai	0.19	
Zhang, Xi	0.19	
Zhao, Heng	0.19	
Zhao, Yuhui	0.19	
Zheng, Jiaojie	0.19	
Zheng, Yue	0.19	
Zibin, Tan	0.19	
Zhou, Chao	0.19	
Salazar, Joelle	0.19	
Shim, Ji- Young	0.19	
<b>FTE Equivalent:</b>	<b>7.98</b>	
<b>Total Number:</b>	<b>42</b>	

### Names of Post Doctorates

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
<b>FTE Equivalent:</b>	
<b>Total Number:</b>	

### Names of Faculty Supported

<u>NAME</u>	<u>PERCENT SUPPORTED</u>	National Academy Member
Brackett, Bob	0.75	Yes
Wasan, Darsh	0.19	Yes
Wan, Jason	0.75	
Kalinowski, Robin	0.88	
Lee, Alvin	0.73	
Cappozzo, Jack	0.26	
<b>FTE Equivalent:</b>	<b>3.56</b>	
<b>Total Number:</b>	<b>6</b>	

### Names of Under Graduate students supported

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
<b>FTE Equivalent:</b>	
<b>Total Number:</b>	

### Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: ..... 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:..... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):..... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense ..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields: ..... 0.00

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### Names of Personnel receiving masters degrees

#### NAME

Apelagunta, Vinil  
Bhaskara, Anuhya Goutham  
Bollam, Sharath Krishna  
Chancharem, Sravani  
Chen, Lu  
Chen, Zhengzai  
Chenna, Santosh kumar  
Chennupati, Sowmya  
Daga, Ashish  
Dai, Guohuan  
Deshpande, Anagha Sudhanwa  
Dunkel, Itunu  
Durczak, Joseph  
Durodola-Anderson, Yetunde  
Guo, Jingxin  
Han, Yibin  
Kamineni, Prashanthi  
Li, Mingming  
Liu, Hui  
Ma, Songchuan  
Madiraju, Aditya  
Narayanan, Kalyani  
Neupane, Drabyendra M  
Pekny, Kyle J  
Prather, Nicholas A  
Ravindran, Shalini  
Samuel Robert, Gladys  
Sapp, Eunice  
Sriperambudur, Sriram  
Sun, Shengqian  
Wang, Qian  
Wei, Kunni  
Xu, Jianwen  
Xu, Meng  
Yang, Fei  
Yen, Li-Han  
Zhang, Sicong  
Zhang, Wenqi  
Zhao, Heng  
Zhao, Kun  
Zheng, Yue  
Zhu, Huajun

**Total Number:**

**42**

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### Names of personnel receiving PHDs

#### NAME

**Total Number:**

---

**Names of other research staff**

<u>NAME</u>	<u>PERCENT SUPPORTED</u>
Chen, Yang	0.17
Grove, Stephen	0.91
Juergensmeyer, Margie	1.00
Krishnamurthy, Kathiravan	0.82
Yettella, Ramesh	1.00
Zhang, Wei	0.50
Al-Taher	0.50
Banazewski, Katarzyna	0.13
Conway, Chris	1.00
Dugan, Shannon	1.00
Halik, Lindsay	0.83
Juskelis, Rima	0.71
Loeza, Viviana	0.83
Lopez, Sal	0.50
Maks-Warren, Nicole	0.77
Pickens, Shannon	1.00
Schwach, Ali	0.17
Swanson, Sara	1.00
Urbanczyk, Michael	1.00
Eberhardt, Ed	0.64
Ginty, Patrick	0.83
Griesemer, David	0.25
Johnson, Dawn	1.00
Karczewski, Michael	0.58
Koschetz, Cindy	0.60
Neuman, Barbara	0.50
Paradis, Armand	0.04
Patazca, Eduardo	0.67
Perez, Ismael	0.52
Steiner, Ed	1.00
Stephens, LaShondra	0.04
Verlarde, Osvaldo	0.58
<b>FTE Equivalent:</b>	<b>21.09</b>
<b>Total Number:</b>	<b>32</b>

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**Sub Contractors (DD882)****Inventions (DD882)**

## **Scientific Progress**

The National Center for Food Safety and Technology (NCFST) is a food safety and applied nutrition research consortium of the US Food and Drug Administration's Center for Food Safety and Applied Nutrition (FDA/CFSAN), the Illinois Institute of Technology (IIT), and the food industry. Established in 1988, the NCFST brings together the expertise of these three sectors for the purpose of enhancing and improving the safety of the food for US consumers. Since 2007, the NCFST has applied its proven collaborative model to the area of nutrition and health promoting foods and the development of food-based solutions for improving public health and reducing disease risk through science.

Since April 2011, NCFST has advanced to become the Institute for Food Safety and Health (IFSH), and NCFST remains within the new IFSH structure as a primary research center coordinating the collaborative research programs in food safety and applied nutrition among FDA/CFSAN, IIT and the member companies. In addition to NCFST, other Centers within the new IFSH structure are Center for Processing Innovation, Center for Nutrition Research, and Center for Specialty Programs.

Research conducted at NCFST addresses key food safety issues facing the country and supports the development of safe food with health-promoting properties from farm to fork. This research forms a scientific basis for policy decisions affecting food safety and public health. Development and coordination of NCFST's scientific research programs are undertaken through the science platforms. Factors considered in the formation of these platforms are: alignment with FDA priorities and strategies; current and future food industry issues; growth potential for the area; opportunities for leveraged research; synergies with IIT; fit with NCFST's unique research capabilities; availability of the necessary expertise, resources and facilities to support the platforms; and interest in the project on the part of all the stakeholders.

### **Research Platform Aims**

The Processing and Packaging Platform aims to provide a scientific basis for the processing and production of safe food, and supports programs related to pasteurization, extended shelf life, sterilization, and package integrity and migration of contaminants.

The Microbiology Platform aims to contribute knowledge about the characteristics, survival, and inactivation of hazardous microorganisms in foods and processing environments in support of food contamination risk assessment and management.

The Food Chemistry Platform aims to investigate approaches to prevent, reduce or mitigate the formation of hazardous chemical contaminants during processing, and the cross-transfer of pre-formed natural toxins, allergens or man-made (environmental) contaminants in the food production environment.

The Proficiency Testing and Method Validation Research Platform aims to provide underpinning science for the development of food microbiological and chemical inter-laboratory studies and proficiency testing programs.

The Nutrition Platform aims to contribute knowledge and advance science on how traditional and novel processing strategies impact the nutritional quality of foods, including bioavailability and bioactivity of nutritional components in biological systems when consumed; with the over-arching goal of optimizing the nutritional quality of processed foods.

The research outcomes of the projects in each Platform have been compiled into an Annual Review of Research document, which is accessible on the IFSH website (<http://www.iit.edu/ifsh>) through the members section.

## **Technology Transfer**

**NCFST/IFSH US Army Project Final Report June 30, 2013**  
**ARO award W911NF-09-2-0051**

**ABSTRACT**

The National Center for Food Safety and Technology (NCFST) is a consortium among Illinois Institute of Technology, The U.S. Food and Drug Administration (FDA) and the food industry. The Annual Review of Research contains reports on collaborative research conducted at NCFST during the fiscal year 2012 (October 1, 2011 through September 30, 2012). NCFST's research is implemented through science platforms that reflect the organization's expertise: food processing and packaging, food microbiology, chemical contaminants and allergens, nutrition, and proficiency testing and method validation programs. The NCFST seeks to build on its strong foundation and history of the collaboration with industry, FDA and academia to increase its research portfolio and expand its partnership with its stakeholders. By conducting important research on critical food processing issues to address food safety and nutrition, NCFST can help improve the health and well-being of the public.

**PUBLICATIONS**

**(a) Papers published in peer-reviewed journals (total 24)**

1. Chen, Yang, Al-Taher, F., Juskelis, R., Wong, J.W., Zhang, K., Hayward, D.G., Zweigenbaum, J., Stevens, J., and Jack Cappozzo. 2012. Multiresidue Pesticide Analysis of Dried Botanical Dietary Supplements Using an Automated Dispersive SPE Cleanup for QuEChERS and High-Performance Liquid Chromatography–Tandem Mass Spectrometry. *Journal of Agriculture and Food Chemistry*. 60(40): 9991–9999.
2. Basavanna, Uma, Skinner, Guy E., and Sharma, Shashi K. 2012. Detecting Botulinum neurotoxin in food: Effective and Sensitive Detection of Clostridium botulinum toxin in foods. *In Clostridium botulinum: a spore forming organism and a challenge to food safety*. Edited by Christine Rasetti-Escargueil and Susanne Surman-Lee. Nova Science Publishers.
3. Buckow R., Semrau J., Sui Q., Wan J., Knoerzer K. 2012. Numerical evaluation of lactoperoxidase inactivation during continuous pulsed electric field processing. *Biotechnology Progress*. 28(5): 1363-75.
4. Burton-Freeman, B., Julie Talbot, Eunyoung Park, Sandhya Krishnankutty and Indika Edirisinghe. 2012. Protective activity of processed tomato products on postprandial oxidation and inflammation: A clinical trial in healthy weight men and women. *Molecular Nutrition and Food Research*. 56(4): 622-31.
5. Daryaei, H. and Balasubramaniam, V.M. 2012. Microbial decontamination of food by high hydrostatic pressure. *In Microbial decontamination in the food industry: Novel methods and applications*. Edited by M. Ngadi and A. Demirci. Woodhead publishing.

6. Deng, X., Li, Z., and Zhang, W. 2012. Transcriptome sequencing of *Salmonella enterica* Enteritidis under desiccation and starvation stress in peanut oil. *Food Microbiology*. 30(1): 311-315.
7. Deng, X., and Zhang, W. 2012. High-throughput sequencing-based methods for molecular typing of foodborne pathogens. In: *DNA Methods in Food Safety: Molecular Typing of Foodborne and Waterborne Bacterial Pathogens*. Edited by Omar A. Oyarzabal and Sophia Kathariou. Wiley publishing.
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17. Li, H., Bhaskara, A., Megalis, C., Tortorello, M.T. 2012. Transcriptomic Analysis of *Salmonella* Desiccation Resistance. *Food Borne Pathogen and Disease*. 9(12): 1254.
18. Li, H., Wang, H., D'Aoust, J. and Maurer, J. 2012. *Salmonella* Species. In *Food Microbiology: Fundamentals and Frontiers, 3rd Ed.* Edited by M.P. Doyle and R.L. Bauchana. ASM Press.
19. Robinson, M., Lu, B., Edirisinghe, I., and C.T. Kappagoda. 2012. Effect of Grape Seed Extract on Blood Pressure in Subjects with Pre-Hypertension. *Journal of Pharmacy and Nutrition Sciences*. 2(2): 155-159.
20. Sun, Y., Laird, D. T., and Shieh, Y.C. Temperature-dependent Survival of Hepatitis A Virus during Contaminated Onion Storage. 2012. *Applied and Environmental Microbiology*. 78(14): 4976-4983.
21. Tadapaneni, R.K., Banaszewski, K., Patazca, E., Edirisinghe, I., Cappozzo, J., Jackson, L., and B. Burton-Freeman. 2012. Effect of high-pressure processing and milk on the anthocyanin

- composition and antioxidant capacity of strawberry-based beverages. *Journal of Agriculture and Food Chemistry*. 60(23): 5795–5802.
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  23. Tulio, A.Z., Jr., Chang, C., Edirisinghe, I., White, K.D., Jablonski, J.E., Banaszewski, K., Kangath, A., Tadapaneni, R.K., Burton-Freeman, B., L.S. Jackson. 2012. Berry fruits modulated endothelial cell migration and angiogenesis via phosphoinositide-3 kinase/protein kinase B pathway in vitro in endothelial cells. *Journal of Agriculture and Food Chemistry*. 60(23): 5803–5812.
  24. Yang, W.W. N.R. Mwakatage, R. Goodrich-Schneider, K. Krishnamurthy, T.M. Rababah. 2012. Mitigation of major peanut allergens by pulsed ultraviolet light. *Food and Bioprocess Technologies*. 5(7): 2728-2738.

**(b) Papers published in non-peer-reviewed journals or in conference proceedings (0)**

**(c) Presentations (total 26)**

***Institute of Food Technology (IFT) Conference – July 2013***

1. Xueyan Wang, Hongliu Ding and Y. Carol Shieh. 2013. Inactivation of Murine Norovirus during Freeze-dry Dehydration of Contaminated Strawberry.
2. Tianyi Jiang, Susanne E. Keller, Emily Larkin. 2013. Growth of *Salmonella* sp. on Different Varieties of Commercially Available Chili Peppers (*Capsicum annum*).
3. Fei Yang, Haiping Li, Yige Bima, Mary Lou Tortorello. 2013. Water Binding Capacity of Low Moisture Food Matrix and *Salmonella* Survival.
4. Jingbo Wang, Yan Sun, Diana S. Stewart, Y. Carol Shieh. 2013. Persistent but Variable Transfers of Norovirus from Blades to Tomatoes during Mechanical Slicing.
5. Shengqian Sun, Nathan M. Anderson, Susanne Keller. 2013. Effect of Abusive Storage Conditions on the Subsequent Inactivation of *Salmonella* on the Surface of Black Peppercorns by Atmosphere Pressure Plasma.
6. Xi Zhang, Binu Bedford, Tong-Jen Fu, Sanjana Nekkanti, Mark Ross, Kristina Williams, Jon DeVries, Brian Pulvermacher, Sefat Khuda, Stuart Chirtel, Lauren Jackson. 2013. Effectiveness of Cleaning Regimens for Removing Peanut, Milk and Eggs Residue from a Pilot-scale Cereal Bar Processing Line.
7. Xueqing Chen, Nathan M. Anderson, Kathiravan Krishnamurthy. 2013. Pulsed Light Inactivation of *Salmonella* spp. on Black Peppercorns.



### ***International Association for Food Protection (IAFP) Conference – July 2013***

1. Tong-Jen Fu, Nicole Maks, Arlette Shazer, Di Xiao. 2013. Evaluation of Commercial Test Kits for Detection of *Salmonella* in Alfalfa Sprout Spent Irrigation Water
2. Mingxia Zang, Yu Tian, Xinhe Wang, David Laird, Tong-Jen Fu. 2013. Investigation on the Spread of *Salmonella* and Factors Affecting the Efficacy of Sanitizer during Postharvest Washing of Lettuce.
3. Jing Xie, Tong-Jen Fu. 2013. Minimizing *Salmonella* Contamination in Sprouts by Controlling the Irrigation Conditions during Germination
4. Ruoyang Xu, Y. Carol Shieh, Diana S. Stewart. 2013. Comparison of RNA Extraction Kits for the Detection of MS2 Coliphage on Green Onion via RT-PCR
5. Nathan M. Anderson, Dana Gradl, Shannon Pickens, Niharika Mishra, Haiping Li, Susanne Keller. 2013. Method of Determine Differences in Thermal Tolerance of *Salmonella* Serotypes at Low Water Activity
6. Chao Zhou, Jianfeng Wang, Mingxia Zang, David Laird, Tong-Jen Fu. 2013. The Impact of Organic Load on the Minimal Level of Chloride Needed to Prevent *E. coli* O157:H7 Cross-contamination during Washing of Fresh-cut Lettuce
7. Kaiping Deng, Xue Wang, Hongliu Ding, Mary Lou Tortorello. 2013. Behaviour of Shiga Toxin-producing *E.coli* (STEC) Strains during Lettuce Washing
8. Michael A. Urbanczyk Jr., Greg Gharst, Robert Newkirk, Robin Kalinowski, Tara Doran, Ruiqing Pamboukian, Wen S. Lin, Ravinder M. Reddy. 2013. Proficiency Testing of Laboratories Analyzing *Shigella flexneri* and *Shigella dysenteriae* from Spiked Sausage
9. Jiaojie Zheng, Songchuan Ma, Dina S. Steward, Joseph E. Schlessner, Y. Carol Shieh, Arlette Shazer, Mary Lou Tortorello. 2013. An Integrated Cell Culture-PCR (ICC-PCR) Assay for Comparing Thermal Inactivation of *Coxiella burnetii* in Skim and Whole Milk
10. Elizabeth M. Grasso, Susanne Keller, Nathan M. Anderson, Stephen F Grove. 2013. Push-through Sanitation of Peanut Butter Processing Equipment
11. Travis R. Morrissey, Viviana Loeza, Guy E. Skinner, Lindsay A. Halik, Eduardo Patazca, Kristin M. Marshall, N. Rukma Reddy, John W. Larkin. 2013. Inactivation of Non-proteolytic Strains of *Clostridium botulinum* Spores by High Pressure and Thermal Processing
12. Louis Nowaczykll, Kristin M. Marshall, Greg Fleischman, Guy E. Skinner, N. Rukma Reddy, John W. Larkin. 2013. The Effect of Sporulation Temperature on the Heat Resistance of *Clostridium botulinum* Type A Spores

### ***FDA Science Day – Foods Program Science and Research Conference - August 2013***

1. Ravinder M. Reddy, Greg Gharst, Steffen Uhlig, Donald H. Burr, Robin Kalinowski, Tara Doran, Thomas E. Graham, Randal Layton, Timothy McGrath, Palmer A. Orlandi Jr., Renate Reimschuessel, Richard E. McDonald. 2013. National Food and Veterinary Proficiency Testing Programs

### ***AOAC International – August 2013***

1. Yang Chen, Ramesh R. Yettella, Sarah Nemser, Andriy Tkachenko, Steve Ensley, Ravinder M. Reddy, Renate Reimschuessel. 2013. Proficiency Test on the Determination of Copper, Iron, Manganese and Zinc in Beef and Goat Liver

***American Chemical Society (ACS) – September, 2013***

1. Meng Xu, Tong-Jen Fu. 2013. Approaches to Quantify and Compare the Thermal Stability of Food Allergens
2. Binu Bedford, Christine H. Parker, Mark M. Ross, Stuart Chirtel, Joseph Jablonski, Lauren S. Jackson. 2013. Transfer of Peanut Proteins into Soybean Oil Used to Roast Peanuts
3. Clair Wei-Ju Chang, Joseph Jablonski, Xitong Li, Lucy Botros, Jeff Moore. 2013. Chemometric Analysis Method Evaluation for Near Infrared (NIR) Spectroscopy-detection of Soybean and Pea Adulterant in Skim Milk Powder (SMP)

***Berry Health Symposium – June 2013***

1. Claire Wei-Ju Chang, Archana Kangath, Indika Edirisinghe, Britt Burton-Freeman, Lauren S. Jackson. 2013. Polyphenol-rich fruits attenuate angiogenesis in vitro in human umbilical vein endothelial cells (HUVEC) exposed to glucose and free fatty acid

***Experimental Biology Meeting – November 2013***

1. Yancui Huang, Brittany Wuchner, Sarah Thomas, Eunyoung Park, Indika Edirisinghe, Britt Burton-Freeman. 2013. Assessing Issue Awareness and Messaging on Purchasing Behavior of Fresh Fruits and Vegetables in Low-income Population

**GRADUATE STUDENTS SUPPORTED**

Name	Percent Supported
<i>Master Degree Students</i>	
Agarwal, Sagar	0.19
Bima, Yige	0.19
Chen, Xueqing	0.19
Chen, Zhengzai,	0.19
Fu, Xiaowen	0.19
Han, Yibin	0.19
Jin, Zhen	0.19
Li, Wenjing	0.19
Lu, Jieling	0.19
Ma, Songchuan	0.19
Mehta, Devanshu	0.19
Na, Qishuo	0.19
Nekkanti, Sanjana	0.19
Sun, Shenqian,	0.19

Jiang, Tianyi	0.19
Vijayakumar, Lakshmi Prabha	0.19
Wang, Jingbo	0.19
Wang, Xue	0.19
Wang, Xueyan	0.19
Wei, Hequin	0.19
Wu, Zhuchun	0.19
Xiao, Di	0.19
Xie, Jing	0.19
Xu, Jianwen	0.19
Xu, Ruoyang	0.19
Xu, Meng	0.19
Yang, Fei	0.19
Yang, Shuopeng	0.19
Yang, Si	0.19
Yen, Lihan	0.19
Yu, Tian	0.19
Zang, Mingxia	0.19
Zhang, Hanshuai	0.19
Zhang, Xi	0.19
Zhao, Heng	0.19
Zhao, Yuhui	0.19
Zheng Jiaojie	0.19
Zheng, Yue	0.19
Zibin, Tan	0.19
Zhou, Chao	0.19

FTE Equivalent: 7.60

Total Master Degree student number: 40

#### *Ph.D. Students*

Salazar, Joelle (Biology Ph.D. Student)	0.19
Shim, Ji- Young (ChBE Ph.D. Student)	0.19

FTE Equivalent: 0.38

Total Ph.D. degree student number: 2

#### *Masters Degrees Awarded*

Apelagunta, Vinil  
 Bhaskara, Anuhya Goutham  
 Bollam, Sharath Krishna  
 Chancharem, Sravani  
 Chen, Lu  
 Chen, Zhengzai  
 Chenna, Santosh kumar

Chennupati, Sowmya  
 Daga, Ashish  
 Dai, Guohuan  
 Deshpande, Anagha Sudhanwa  
 Dunkel, Itunu  
 Durczak, Joseph  
 Durodola-Anderson, Yetunde  
 Guo, Jingxin  
 Han, Yibin  
 Kamineni, Prashanthi  
 Li, Mingming  
 Liu, Hui  
 Ma, Songchuan  
 Madiraju, Aditya  
 Narayanan, Kalyani  
 Neupane, Drabyendra M.  
 Pekny, Kyle J.  
 Prather, Nicholas A.  
 Ravindran, Shalini  
 Samuel Robert, Gladys  
 Aiswarya  
 Sapp, Eunice  
 Sriperambudur, Sriram  
 Sun, Shengqian  
 Wang, Qian  
 Wei, Kunni  
 Xu, Jianwen  
 Xu, Meng  
 Yang, Fei  
 Yen, Li-Han  
 Zhang, Sicong  
 Zhang, Wenqi  
 Zhao, Heng  
 Zhao, Kun  
 Zheng, Yue  
 Zhu, Huajun

Total Number: 42

## **FACULTY**

Name	Percent Supported	National Academy Member
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Brackett, Bob	0.75	Yes
Wasan, Darsh	0.19	Yes
Wan, Jason	0.75	No
Kalinowski, Robin	0.88	No
Lee, Alvin	0.73	No
Cappozzo, Jack	0.26	No
FTE Equivalent:	3.54	
Total Number: 6		

#### **Other Research Staff**

<b>Name</b>	<b>Percent Supported</b>
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Chen, Yang	0.17
Grove, Stephen	0.91
Juergensmeyer, Margie	1.00
Krishnamurthy, Kathiravan	0.82
Yettella, Ramesh	1.00
Zhang, Wei	0.50

Al-Taher	0.50
Banazewski, Katarzyna	0.13
Conway, Chris	1.00
Dugan, Shannon	1.00
Halik, Lindsay	0.83
Juskelis, Rima	0.71
Loeza, Viviana	0.83
Lopez, Sal	0.50
Maks-Warren, Nicole	0.77
Pickens, Shannon	1.00
Schwach, Ali	0.17
Swanson, Sara	1.00
Urbanczyk, Michael	1.00

Eberhardt, Ed	0.64
Ginty, Patrick	0.83
Griesemer, David	0.25
Johnson, Dawn	1.00
Karczewski, Michael	0.58
Koschetz, Cindy	0.60
Neuman, Barbara	0.50
Paradis, Armand	0.04
Patazca, Eduardo	0.67
Perez, Ismael	0.52
Steiner, Ed	1.00

Stephens, LaShondra	0.04
Verlarde, Osvaldo	0.58
FTE Equivalent:	21.08
Total Number:	32

## SCIENTIFIC PROGRESS AND ACCOMPLISHMENTS

The National Center for Food Safety and Technology (NCFST) is a food safety and applied nutrition research consortium of the US Food and Drug Administration's Center for Food Safety and Applied Nutrition (FDA/CFSAN), the Illinois Institute of Technology (IIT), and the food industry. Established in 1988, the NCFST brings together the expertise of these three sectors for the purpose of enhancing and improving the safety of the food for US consumers. Since 2007, the NCFST has applied its proven collaborative model to the area of nutrition and health promoting foods and the development of food-based solutions for improving public health and reducing disease risk through science.

Since April 2011, NCFST has advanced to become the Institute for Food Safety and Health (IFSH), and NCFST remains within the new IFSH structure as a primary research center coordinating the collaborative research programs in food safety and applied nutrition among FDA/CFSAN, IIT and the member companies. In addition to NCFST, other Centers within the new IFSH structure are Center for Processing Innovation, Center for Nutrition Research, and Center for Specialty Programs.

Research conducted at NCFST addresses key food safety issues facing the country and supports the development of safe food with health-promoting properties from farm to fork. This research forms a scientific basis for policy decisions affecting food safety and public health.

Development and coordination of NCFST's scientific research programs are undertaken through the science platforms. Factors considered in the formation of these platforms are: alignment with FDA priorities and strategies; current and future food industry issues; growth potential for the area; opportunities for leveraged research; synergies with IIT; fit with NCFST's unique research capabilities; availability of the necessary expertise, resources and facilities to support the platforms; and interest in the project on the part of all the stakeholders.

### Research Platform Aims

**The Processing and Packaging Platform** aims to provide a scientific basis for the processing and production of safe food, and supports programs related to pasteurization, extended shelf life, sterilization, and package integrity and migration of contaminants.

**The Microbiology Platform** aims to contribute knowledge about the characteristics, survival, and inactivation of hazardous microorganisms in foods and processing environments in support of food contamination risk assessment and management.

**The Food Chemistry Platform** aims to investigate approaches to prevent, reduce or mitigate the formation of hazardous chemical contaminants during processing, and the cross-transfer of pre-formed natural toxins, allergens or man-made (environmental) contaminants in the food production environment.

**The Proficiency Testing and Method Validation Research Platform** aims to provide underpinning science for the development of food microbiological and chemical inter-laboratory studies and proficiency testing programs.

**The Nutrition Platform** aims to contribute knowledge and advance science on how traditional and novel processing strategies impact the nutritional quality of foods, including bioavailability and bioactivity of nutritional components in biological systems when consumed; with the over-arching goal of optimizing the nutritional quality of processed foods.

The research outcomes of the projects in each Platform have been compiled into an Annual Review of Research document, which is accessible on the IFSH website (<http://www.iit.edu/ifsh>) through the members section.